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Students' qualification in environmental and sustainability education—epistemic gaps or composites of critical thinking?

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ABSTRACT

In an 'age of measurement' where students' *qualification* is a hot topic on the political agenda, it is of interest to ask what the *function of qualification* might implicate in relation to a complex issue as Education for Sustainable Development (ESD) and what function environmental and sustainability issues serve in science education. This paper deals with how secondary and upper secondary teachers in discussions with colleagues articulate qualification in relation to educational aims of ESD. With inspiration from discourse theory, the teachers' articulations of qualification are analysed and put in relation to other functions of education (qualification, socialisation and subjectification). The results of this study show three discourses of qualification: *scientific reasoning*, *awareness of complexity* and *to be critical*. The discourse of 'qualification as to be critical' is articulated as a composite of differing epistemological views. In this discourse, the teachers undulate between rationalistic epistemological views and postmodern views, in a pragmatic way, to articulate a discourse of critical thinking which serves as a reflecting tool to bring about different ways of valuing issues of sustainability, which reformulates 'matter of facts' towards 'matter of concerns'

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Introduction and background

Today, sustainable issues are commonly interpreted as multidisciplinary wicked problems characterised by complexity, uncertainty and risk, and therefore open to uncertainty and contestation (Scott & Gough, 2003). Our world is considered to carry complex problems without simple relationships of cause and effect or any obvious solutions (cf. Barrue & Albe, 2013; Beck, 1992; Jickling & Wals, 2008). However, the interrelations between environmental, social-cultural and economic concerns are still key issues of sustainability. Among the educational content concerning sustainable development, we find issues as climate change, the use of natural resources, human rights, democracy and justice. In other words, it means a broad and interdisciplinary obligation. Further the relationship between knowledge, politics and ethics is complex and sensitive; hence, how to approach education when it comes to perspectives of sustainability is a question in discussion.

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Therefore, one might still ask how education should deal with these questions embedded by political and ethical considerations.

In November 2014 the initiative and mission of the United Nations Decade of Education for Sustainable Development (2004–2014) were reinforced by the Global Action Plan, where the aim of Education for Sustainable Development (ESD) is seen as an integral element of *quality education* and a key enabler for sustainable development, a universal plan ‘to generate and scale-up action in all levels and areas of education and learning in order to accelerate progress towards sustainable development’ (Unesco, 2013; www.unesco.org). In an ‘Age of Measurement’ (Biesta, 2009), where students’ *qualification* is a hot topic on the overall political agenda—it is of interest to ask what qualification might implicate in relation to ESD. Therefore, to find contributions to this discussion, we in this study turn to teachers’ social practice, to analyse how professional teachers articulate qualification in relation to their teaching practice of ESD. Hence, the aim of this study is not to outline a ‘best practice’ of ESD, but rather to learn from teachers’ experiences to exemplify how a universal concept as ESD could be particularised in practice.

Issues of sustainability in education have followed a winding path through practice in science education: From traditionally being based on natural science subjects—emphasising nature conservation and content knowledge as environmental education—to subsequently approach socio-scientific issues (SSI) (cf. Sadler, 2004), scientific literacy (cf. Linder et al., 2011) and a vision II perspective (Roberts, 2007).

Previous studies have shown how issues of environmental education could be hard to fit into a world of schooling and qualification with predefined learning goals, control and assessments (Stevenson, 2007). Likewise, environmental sustainability education and science education are described as increasingly distant. The question has been raised, if environmental sustainability education and science education should be different branches of education or develop towards a more symbiotic relationship (Wals, Brody, Dillon, & Stevenson, 2014).

However, sustainable development and scientific literacy as integral dimensions of science education might work to open up science education to personally relevant questions (Zeyer & Kyburz-Graber, 2012) and may enable a participation in political discourse (Zeyer & Dillon, 2014). In what way priorities in students’ justification of ethical and/or scientific arguments in SSI/ESD are due to students’ preferences or related to students’ learned skills is identified as an issue for further elaboration in science educational research, by for example Grooms, Sampson, and Golden (2014). Anyhow, ESD often has an explicit purpose to ‘encourage changes in behavior that will create a more sustainable future’ (Unesco, 2013; www.unesco.org), which distinguishes it from science literacy and SSI.

When qualification is a tool of socialisation, to enhance changes in individual’s behaviour as a way to be able to contribute to the solution of environmental problems, this also means that one fosters individuals for a particular outcome within a predefined society. This way to frame processes of social change has been defined as citizenship-as-achievement (Biesta, 2004, 2006; Lawy & Biesta, 2006). Van Poeck and Vandenabeele (2012) question the contemporary tendency in education to treat issues of citizenship and democracy as a challenge for individuals to acquire competencies necessary to take part in the society. The relation between knowledge, values, politics and ethics in issues of

sustainability is complex and sensitive (Hasslöf, Ekborg, & Malmberg, 2014; Jickling & Wals, 2008; Lundegård & Wickman, 2007) and recent studies have addressed the need to re-politicise issues of sustainability in education (Lundegård & Wickman, 2012; Sund & Öhman, 2014; Van Poeck & Vandenabeele, 2012), and thus connect matters of facts with values and opinions to ‘matters of concerns’ (Latour, 2010).

To focus the issue of qualification in relation to ESD, we formulated the following research question: Which central meaning of qualification becomes articulated when a group of experienced teachers discuss what they regard as important in ESD?

Methodology

When discussing the purpose of education, one might discuss the contribution education brings to the individual, as well as to the society as a whole, that is, what Biesta (2009) refers to as ‘the functions of education’. Here, we are interested in the teachers’ meaning-making in discussions about the purpose of ESD, particularly in relation to *qualification*. However, in line with Biesta (2009) we prefer to define qualification as *a relational function* of education; that is, how qualification is continuously related to *socialisation* and *subjectification*.

These functions could also be seen as a foundation for discussions of what might constitute a ‘good’ education. Here, we are interested in the teachers’ meaning-making in discussions about purposes of ESD, particularly in relation to *qualification*. The *function of qualification* refers to how knowledge, skills and understanding allow students to ‘do something’. It also refers to the contribution that education brings to students’ common development and growth, as well as to their political and cultural literacy.

Through *socialisation*, education inserts individuals into existing ways of doing and being. It serves to introduce newcomers into particular social practices in order to become parts of the existing ‘order’. In other words, socialisation transmits particular norms and values, that is, a continuation of culture and tradition. *Subjectification*, on the other hand, has to do with the uniqueness and freedom of human beings. In this paper, we relate freedom to subjectification, not exclusively in connection to empowering actions or based on the notion of rationality, but instead, in connection with responsiveness and reciprocity (Biesta, 2006; Lundegård & Wickman, 2012; Todd, 2009; Todd & Säfström, 2008).

In our analyses, these three functions are seen as relational parts in education. Accordingly, when studying how qualification could be articulated in relation to ESD, we analyse how qualification is articulated in relation to socialisation and the possible room for students’ subjectification, in order to problematise their interrelations. In the analyses, we use the meaning-making of teachers’ discussions with colleagues about what they regard as important aims of ESD. From this situated practice, we discuss how articulations of *qualification* create meaning in relation to the purpose and functions of ESD.

Empirical setting

The empirical material consists of five (audio-recorded) occasions of discussions, from teacher colleagues’ meaning-making about purposes of ESD. The participants were science and social science teachers from secondary and upper secondary schools in the

south of Sweden. The schools were selected on the basis that they were certified as ESD schools or involved in a project concerning sustainability. All of the selected teachers expressed interest in this type of collegial discussion, and each focus group was set up with three to six teachers. In total, 20 teachers from 7 different schools took part. Four groups constituted of teacher teams already working at the same school, and one group was made up of teachers from different schools who worked together on a joint Swedish–Danish pedagogical project of ESD.

Each focus group discussion, lasting approximately one hour, was recorded and transcribed. The semi-structured discussion was initiated by a formal question from the first author of this study who asked them to describe what they regard as most important in teaching and learning in sustainable development and if they might have missed some processes of importance during their latest project. During the discussion, comments and questions were posed from the researcher just to clarify statements or to bring the discussion back to its original theme. The transcripts of these discussions constitute the empirical basis of the following discourse analyses.

Analytical framework

With inspiration from discourse theory (Laclau & Mouffe, 2001), we study teachers' articulations of students' qualification in relation to ESD. The analyses in this study draw on the analytical methods developed in earlier studies (Hasslöf & Malmberg, 2015), with inspiration from the applied discourse theoretical analysis by Unemar Öst (2009).

To elaborate on discourse theory—analysing the constant struggle between definitions—is a useful approach in making the re-articulation of ESD discourses visible and possible to problematise. With awareness of Laclau and Mouffe's wider societal and political focus and interest in theory development, we try to adapt their analytical framework to our own more restricted purpose and research question. This means to narrow the focus to analyse the social practice of school teachers' reciprocal discussions about students' qualification in relation to ESD.

These meaning-making discussions imply the mutual exchange of meanings in which certain interpretations emerge as significant. Utterances/elements are in an ongoing re-articulation and develop significant meaning in relation to each other. According to Laclau and Mouffe (2001, p. 105): '(...) we will call *articulation* any practice establishing a relation among elements such that their identity is modified as a result of the articulatory practice. The structured totality resulting from the articulatory practice, we will call *discourse*'.

Since discourses are formulated by the ongoing exchange of meaning in social practices and creates meaning in the specific social context they are part of, the *ongoing communication* is crucial in the analysis. Therefore, the starting point for our analysis is based on experienced teachers' discussion about what *they* regard as important from their own practice in ESD.

To analyse how discourses are crystallised (to make particular meaning) by articulations in discussions requires a close reading with a reciprocal exchange between transcripts and the analytic framework. In relation to *qualification*, different definitions, experiences and viewpoints are discussed and in a struggle to make meaning. In the analysis, we bring

some of the central concepts of Laclau and Mouffe's (2001) theoretical framework into play; but first we must give some further explanations.

We start by defining qualification in ESD as a discourse in articulation. As such, qualification has not an explicit articulation by any particular formulation; instead, there is a struggle between competing interpretations trying to make their definition the central one. Hence, we focus how teachers articulate students' qualification in relation to ESD.

Certain tokens (i.e. utterances/elements) which develop as elements of central structuring function within a discourse are called *nodal points*. They constitute privileged central meaning, which organises related *elements* (utterances) in a crystallisation of equivalence. When mutual meaning is crystallised, the elements turn into *moments* of the discourse. Moments are defined elements, which have a mutual *and* partly differential meaning in relation to the mutual nodal point. The nodal points together with the relational moments constitute and define the (temporarily) crystallised *discourse*, which, in our case, represents the meaning of qualification in ESD. Elements not yet articulated in the discourse might cause new articulations and progressively be defined as moment and thereby re-articulate the discourse. The reciprocity and tensions between articulated elements are always in focus in the analysis.

The analysis is performed in three steps. Firstly, we identify the teachers' utterances/statements as *elements* when they describe situations in relation to students' qualification in ESD. Secondly, we analyse how some elements work to embrace the central meaning of the conversation (*nodal points* in articulation). In relation to this central concept, there is a struggle of related elements to define the particular meaning of the nodal point (elements in articulation). Finally, we identify how those elements relate to each other to become *moments* which crystallise and distinguish the nodal point of the discourse formulated by the teachers' articulations. In this case, this summarises the *discourse* concerning qualification.

Analyses and results

The following dialogues illustrate how the participating teachers articulate students' qualification as three recurring 'themes' (nodal points) which constitute privileged central meaning. These three nodal points are articulated as follows: (A) qualification—as scientific reasoning, for example, as to be able to use the concept 'energy flow' in a proper way in arguments concerning sustainable issues; (B) qualification—as awareness of complexity, for example, to understand knowledge as related to the context and used differently depending on viewpoint and (C) qualification—as to be critical, for example, to be able to critically evaluate and to think from one's own position. Later in this section, when we illustrate the analytical process, we will further clarify the nodal points. How the participating teachers articulate the students' qualification and how the meaning crystallises due to the articulation of nodal points are exemplified.

Meanwhile the nodal points are being articulated, the struggling meaning of qualification expands. It is these dynamic processes we focus in the following analysis. The nodal points reflect different approaches or views on qualification in the teachers' discussions. Firstly, we show how these nodal points are crystallised into particular meaning by elements in articulation. Secondly, in the section 'Discussion', the interrelations between these nodal points are further elaborated.

A. The nodal point qualification as scientific reasoning

Scientific knowledge and rationality are articulated as important foundations of students' qualification. The articulation of this nodal point is exemplified by four elements in articulation.

(A1) The first element exemplifies how the teachers articulate what they regard as important to enhance good quality in student discussions about sustainability issues. Alice talks about the importance of 'general' concepts:

Alice: ... there's a number of, like, **general ... concepts**, that I think they should use when it comes to environmental problems ... so that they can confront any environmental problem whatsoever and consider ... what is the problem here? ... of an environmental problem ... **and then take a stand** ... That's what I think ...

Mark: ... but do you mean as a 'tool'?

Harry: a discussion tool ... / / ...

Alice: ... how environmental problems appear, from all these aspects, like: cycles, sufficient natural resources, is the development sustainable? ... and so on. I think this could make a huge impact, how they may be able to take any problem and analyse with respect to this ...

Mark: ... like, for example, (natural) cycles, that they always are considering this ...

Paola: Mmm ...

Mark: How energy flows, how matter circulates in different cycles ...

Paola: Mmm ...

Alice: Absolutely.

Mark: then it's a **real discussion** as well and, besides, one can still have different opinions about energy sources, which ones to prefer and so on ... for example ...

In this articulation, knowledge about natural science is articulated as a tool for the students when approaching sustainability issues. The view of sustainability as environmental problems that can be evaluated through certain biological/ecological concepts is put forward. With scientific reasoning, discussions become 'real', and constitute something that other arguments, based more on opinions, can be founded upon. Scientific knowledge is required as a qualification for 'real discussion'. The students need to acquire general science concepts to understand and be able to get into 'real discussion' and to take a stand. *Element: General concepts to take a stand. A real discussion.*

(A2) The second element verifies this connection between specific factual knowledge and arguments by the discussion in another situation. In this articulation, students' reasoning is also correlated to the prerequisites in the curriculum goals:

Larry: A **well-informed reasoning** ... must be based on knowledge ...

Jack: you can't get anywhere, if you just have a lot of opinions not **grounded by facts** ...

Sue: or ...

Jack: then you won't make it, you can't pass for your grades, that's what we're trying to clarify, it's our job to make them understand the prerequisites ...

Here, the qualification is articulated in relation to assessment and how to fulfil the requirements for the course. The prerequisites for a 'well-informed reasoning' are articulated as a need of a knowledge base when grounding opinions. *Element: Well-informed reasoning. Grounded by facts.*

(A3) The third element is derived from a sequence where the teachers talk about how to make students' discussion into 'proper reasoning' of sustainability. In this sequence, the qualification is articulated in a similar way as in the examples above. This articulation relates reasoning to a certain level of scientific knowledge to qualify as 'proper reasoning':

Simone: ... the proper reasoning [about sustainability] will perhaps not be possible until the B-courses ... before you will be able to reflect on something, you have to, after all, have a basic understanding ...

Robin: Then you know what can be assumed ...

Simone: Mmm ...

Robin: ... somehow, but first they have to have the basic knowledge ...

Simone: Yeah, exactly.

Robin: He, he ... and then it might not be the same type of reasoning.

A basic understanding—related to a specific course grade—is articulated as the need to be able to reflect on sustainability. The students need to acquire certain basic knowledge for proper reasoning. *Element: Basic knowledge for proper reasoning.*

(A4) Likewise, the fourth element articulates the importance of students' scientific understanding, when the teachers discuss the importance of education in relation to sustainability.

Lena: ... I think that the schools' aim is to give students, the **scientific** part, their **understanding** of the **science behind** [in issues of sustainability] ... and then take a position, after that, because it's very much emotion and other things influencing ...

Paul: Yeah.

Lena: ... especially in the media ... **to make it correct**, we have an important part here ...

Henrik: Yeah, I agree.

In this articulation, 'the science behind' is seen as knowledge of sustainability that the students need before they 'take a position', and to help distinguish 'knowledge' from emotions, to understand, for example, information in media correctly. *Element: Scientific understanding. To make it correct.*

Summarising remarks

To be scientifically knowledgeable is more or less ever-present in this discourse of qualification. The discernible crystallisation articulates *scientific knowledge* as a prerequisite for a *rational reasoning* and as an objective reference in discussions of sustainability. Scientific knowledge is articulated as, for example, a prerequisite for discussions, to build substantial arguments, ‘proper’ *reasoning*, and a prerequisite for decision-making and opinions (to take a stand). In this way, the elements articulate relational meaning and become moments that drive the meaning of the discourse and define the nodal point with a particular meaning of qualification in relation to ESD. The crystallised discourse formulating *scientific reasoning as a qualification of ESD* consists of the following moments:

Scientific reasoning as qualification of ESD

- (1) General concepts to take a stand. A real discussion.
- (2) Well-informed reasoning, grounded by facts.
- (3) Basic knowledge for proper reasoning.
- (4) Scientific understanding. To make it correct.

This discourse formulates qualification towards a scientific reasoning of sustainability issues, where scientific knowledge and concepts are given priority. It articulates a neutral, rational worldview with science as a model to interpret issues of sustainability. In this discourse, there are also moments articulating qualification in relation to grades and standards in the curriculum.

B. The nodal point qualification as awareness of complexity

Beside the above rational science approach of ESD, a struggling nodal point of qualification is articulated—a nodal point emphasising an *awareness of complexity*. We exemplify the articulation of this nodal point by four different elements.

(B1) The first element articulates knowledge as unreliable and context dependent. The teachers discuss how students should be qualified to contribute to a more sustainable future in everyday practice. In this articulation, the difficulties of a teaching approach based on factual knowledge—towards emphasising certain choices—are put forward.

- Ron: We ought to make them [the students] aware, but sometimes it can feel a bit frustrating, for example, if you do not know, **we do not know what we can influence**, or some things we cannot control at all. I think of, for example, CFLs [energy saving light] ... sometimes ... now they have stopped making them [the lights with filament] to save electrical energy, right? That’s how it all began, wasn’t it?
- Paola: yeah ...
- Ron: ha, ha ... but the lights [energy saving] contains lots of me ... mer ...
- Paola: mercury ...
- Lena: mercury, yea ...
- Ron: and they break too, they’re also used up, right? ... Uh, so where is the balance?

- Paola: yeah ...
- Ron: and in connection to induction ... because ... because it's ... it'll be the right idea, using CFLs, we count on it to show how much energy we save ...
- Lena: yes ...
- Ron: but ha, ha ... on the other hand ... they say ... about the light bulbs, maybe we cause more damage if we change, right? ... so, you may feel a bit frustrated about this ...
- Lena, Paola: Yeah, yes.

This example shows the difficulties in making certain choices due to particular knowledge. The utterance articulates the problem of using fact-based knowledge from one perspective as universal or objective, to guide students towards certain 'sustainable' choices. The dilemma of 'sustainable choices' is revealed due to the complexity of variables. *Element: We do not know what we can influence.*

(B2) The next element becomes articulated as the teachers discuss the importance for students to evaluate and develop a critical attitude towards different sources.

- Simone: Yes, it's this about being critical to sources. I have told my students 'Well, **what I say today may not be true in twenty years ...**'
- Alice: Yes, exactly.
- Simone: ... **or even in five, ten years. Things happen after all** ... but they must have a responsibility **to learn for themselves** and [pause] not to just believe what people say, but rather, to kind of, investigate ...

To know that 'facts of today' are not static but progressing is articulated as a qualification. It also expresses how a student ought to handle, relate and approach information. It emphasises the need to evaluate the reliability of factual knowledge over time and not simply take anything as everlasting 'truth'. It articulates an approach towards life-long learning since knowledge is seen as context dependent and changing. *Element: Knowledge as changing*

(B3) The third element articulates how to approach otherness and alterity in connection to universal concepts, stressing an awareness of differences.

- Alice: I do not think we can cast all [the students] into the same mould, and we shouldn't, that's what we shouldn't do in education ... so you have different views on human rights and sustainable development. We notice this when they have discussions, I think it is not a given.

This utterance articulates respect for different interpretations to universal concepts. The importance to keep an awareness of openness for different perspectives is emphasised. *Element: Different views as part of education*

(B4) The fourth element is developed in a similar way. The following articulation comes from a situation described by the teacher, John, referring to a conversation with some of his students (who avoids pork for religious reasons). The students meet a new perspective

which challenges their existing order. The articulation develops when John is discussing with his teacher colleagues about different views of issues and how teachers might guide the students' answer.

John: I said at some point, there was someone who asked ... but I'm not an expert so, really, I should not say much about it, but I mentioned in some context that pork makes less of an environmental impact than beef production, and then I saw that they were really puzzled and did not know ... what they should do with the information, and so ...

Lotta: Difficult ...

John: Well, yea, he, he ... it was strange, there were two completely different levels of their existence that clashed, and they didn't know what to do with them at all ...

Hanna: How did you feel? How did you deal with it?

John: Oh, I think it came out pretty well, because I think it was clear that **I was not looking for ... well ... that they should decide here and now to ... to think in this or that direction**, but more of ... no, it was pretty good that they could see that you can ... see it from different perspectives.

This articulation is an example of how the teacher articulates the teaching situation as open ended, not emphasising a particular outcome from a causal knowledge view.
Element: open-ended outcomes

Summarising remarks

Awareness of complexity is articulated as a struggling nodal point of the discourse of qualification in ESD. The elements and nodal point are crystallised into a discourse which formulates issues as open ended, changeable and context dependent and advocate an approach of qualification as an act of listening and 'searching' to become open minded and aware of complexity. It is articulated as situations where students could reflect without predetermined knowledge claims, guiding them to a specific answer or superior value. The articulations formulate an approach where respect for different ways of valuing issues is seen as a qualification for dealing with issues of sustainability. The discourse formulating *awareness of complexity* as a qualification in ESD consists of the following moments:

Awareness of complexity as qualification in ESD

- (1) We do not know what we can influence.
- (2) Knowledge as changing.
- (3) Different views as a part of education.
- (4) Open-ended outcomes.

This discourse is formulating qualification as a more diverse view to approach sustainable issues. Mainly, it formulates how the teachers frame certain situations and how to approach knowledge and alteration in teaching situations. This discourse articulates reasoning not necessarily as rational, that is, a more postmodern view of knowledge.

The nodal point *awareness of complexity* articulates an approach of qualification as to become aware and conscious of complexity.

So far, we have noticed how *qualification* is articulated differently in relation to the nodal points of qualification *as scientific reasoning* and *as awareness of complexity*. The different meanings of the two crystallisations are articulated in relation to purposes in teaching and learning; that is, predefined science knowledge to ‘learn’ and a more complex learning process with an open-ended outcome, that is, as different epistemological views. This puts students in different positions to approach issues of sustainability in social contexts and, in relation, to be able to fulfil the requirement as ‘qualified’ to reason.

C. The nodal point qualification as to be critical

Facing the above-mentioned differences, it is interesting to notice the meaning of a third mutual articulated nodal point. It is articulated by elements circulating in the teachers’ discussions that could belong to each of the earlier crystallisations and as well have a slightly different meaning. These articulations focus on *how to take action as an educated student*, an approach to challenge taken-for-granted habits and value things in new perspectives.

(C1) The following articulations develop in a context where the teachers discuss students’ ability to change lifestyle in relation to a ‘sustainable future’. The first example from those elements in articulation expresses students’ qualification as being able to reason and act in an ‘independent’ way—to be able to question behaviours in society—due to the basis of scientific knowledge. This articulation is developed when the teachers discuss the use of knowledge.

Andy: ... and above all, students need more knowledge and scientific literacy ... driving force in man, to be like everyone else, it is beyond all imagining ...

Robin: yeah ...

Andy: They are even unconscious in a frightening way ... but, **to think freely** ... I think it is the greatest ... danger ... when, suddenly, all begins ... what should I say? Eat healthy, sort garbage, biking to work or whatever it is ... above all, to get used to, again, **to think for yourself** ... uh, more than you’re used to ... everything you hear, everything you see – is that right? Could it be that way? Like separating waste ... ask yourself ‘why should I do it?’ / ... / [They need] knowledge that ... there is this **scientific knowledge to questioning things**: Why am I doing things the way I do? Why are people doing things the way they do? / ... / Instead of ‘No, it’s probably best that I do like the others – yes’.

Students’ qualification is articulated as a competence to use scientific knowledge to challenge taken-for-granted habits, to questioning things and ‘think freely’. Scientific literacy is seen to act as an eye-opener and provide students with tools to evaluate the world in a critical way; a socialisation into a critical thinking of action on a scientific base. In this way, students’ qualification is articulated as a way to make conscious decisions in actions through scientific literacy. *Element: Scientific knowledge to questioning things, to think freely and to think for yourself.*

(C2) The second element articulated in relation to this context is developed when the teachers discuss purpose of education as a way to balance predefined worldviews with new perspectives.

Larry: ... to be able to reason with yourself, one has **to take part of different perspectives** ...

Jack: Yeah ...

Larry: so I think it is a process ...

Jack: but it is not always ...

Larry: There is a risk, otherwise, that students already have **ready-made solutions** from home, without knowing any other perspectives, that's why it's very important to show different perspectives ...

Jack: yeah ...

/ ... /

Larry: they [the students] need this tool **to be able to critically evaluate**, to have those different perspectives and sustainable development, human rights, economic perspectives ... different ones ...

Students' qualification is articulated as an ability to reason from different perspectives. To be able to reason in a way that could critically challenge that, for example, 'ready-made' one-sided solutions, is seen as a qualification. By this, part of students' qualification is articulated as an ability to be aware of and able to value different perspectives. *Element: To take different perspectives to reason and evaluate.*

Summarising remarks

This nodal point is articulated as using knowledge and scientific literacy to enable students to critically evaluate everyday habits, behaviours and opinions. The desirable qualification is articulated as being able to distinguish the taken for granted and, by this, develop a critical attitude and independence. In the first articulation, *scientific knowledge* and literacy are mentioned as a resource of critical reflection. The second articulation puts forward the importance to challenge predefined solutions with *different perspectives* as a desirable teaching aim. Both articulations emphasise qualification as a way for students to be able to challenge predefined solutions and values. The nodal point that articulates the discourse of *critical thinking* as qualification in ESD consists of the following moments:

Critical thinking as qualification in ESD

- (1) Scientific knowledge to questioning things.
- (2) Different perspectives to reason and evaluate.

The discourse of *critical thinking as qualification in ESD* is crystallised in relation to how the teachers articulate students' desirable action. Scientific literacy is articulated as a competence, enabling students to critically value and challenge behaviours from a *scientific rational* point of view (C1). However, awareness of *alternative ways of thinking* to enable for students to critically value and challenge taken-for-granted solutions

simultaneously is a desirable qualification (C2). This shows how two different epistemological views are articulated in the same discourse.

Conclusion and discussion

The aim of this study was to analyse how teachers in meaning-making discussions articulate *qualification* when ESD is regarded as an overarching perspective in their teaching practice. Environmental and sustainability education brings with it contested concepts which develop and change over time and thereby calls to be continually recreated in relation to education (Jickling & Wals, 2008; Scott & Gough, 2003; Stevenson, 2007). How the meanings and purposes also need to be developed by teachers themselves to make meaning in the particular context are arguments stated by previous research (Stevenson, 2007). This empirical study should be seen as a perspective-generating contribution to particularise and discuss teachers' articulation of educational purposes of desirable aims of ESD, with a special focus on students' *qualification*. Through the analysis, partly struggling discourses (nodal points) of qualification are revealed and a special focus is put into analysing the intersections (Figure 1).

How students' qualification emerges as struggling and partly overlapping discourses, differentiated by different epistemological views and teaching aims, also adds to the discussion of convergence between science and environmental/sustainability education (Wals et al., 2014).

A. Qualification as scientific reasoning

Teaching aim: schooling; goals in curricula and assessment, a rationalistic objective view of knowledge, socialisation towards fact-based knowledge.

B. Qualification as awareness of complexity

Teaching aim: responsiveness: awareness of complexity in our world, enables room for subjectification processes.

C. Qualification as to be critical

Teaching aim: socialisation focused on students' action, developing reflective critical thinking, consciousness and freedom.

In the first discourse, the nodal point *qualification as scientific reasoning* becomes an individual competence that is needed for an individual's behavioural change, and further, for the ability to contribute to the solution of environmental problems. This nodal point (A) relates to the theoretical concept 'citizenship-as-achievement', as elaborated by Van Poeck and Vandenabeele (2012). It formulates a neutral, rational worldview with science as the main model to interpret issues of sustainability. Qualification to 'citizenship-as-achievement' requires schooling to achieve competences in regard to make proper decisions. Competences representing this view of citizenship are achieved through a learning characterised as a reproduction of existing orders, as consensus-oriented and promoting linear processes of learning. Scientific reasoning, as articulated by the teachers, is a discourse where scientific arguments have to be *distinguished* from other arguments, when students discuss issues of sustainability. This is related to measurement, grades and assessments of learning goals. Scientific reasoning is formulated as an

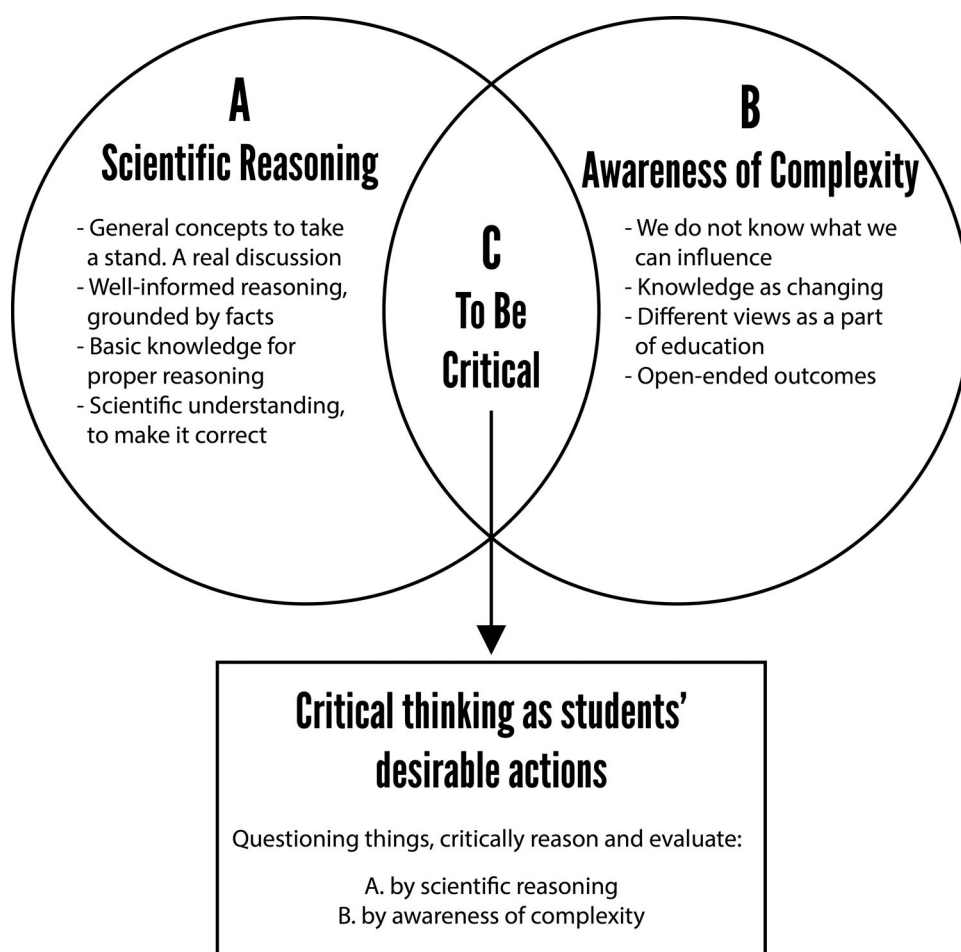


Figure 1. Teachers' articulation of struggling ESD discourses of qualification.

objective reference in connection to issues of sustainability. With reference to this discourse, one might ask which arguments are seen as legitimate in issues with ethical and political values (i.e. sustainable development) in a school context? Which reasoning is regarded as 'qualified' and proper?

At the same time the teachers' articulations are constructing another nodal point (B): *qualification as awareness of complexity*. Issues of sustainability are approached in a quite different way. Here, teachers articulate qualification as the ability of students to open up for different perspectives to value things and to realise that knowledge is context dependent and changing. Reasoning is not emphasised as exclusively predefined and fact based. The teachers articulate the importance of different ways to reason about sustainability. When this discourse is articulated, a postmodern view of knowledge and a pluralistic view of sustainability issues are approached. This discourse is challenging the former in which learning was characterised as a reproduction of existing orders. This discourse relates to the process of subjectification, the 'coming into presence', with possibilities to question existing orders (Biesta, 2006).

What we can notice is that teachers *at the same time* are articulating predefined knowledge goals as an end and a more pluralistic learning process with open-ended outcomes. In connection to the former nodal point, students' possibility to explore how different values related to sustainability issues, like political and ethical views, is diminished. In other words, the subjectification process is not an explicit part of the discourse *Qualification as scientific reasoning*. What role assessments, due to curriculum goals, have in relation to what is valued in learning situations of ESD is a question for further research to scrutinise.

The two discourses highlighted so far in the discussion might look as crystallised discourses parted by two different epistemic paradigms and thereby also separated in educational context. However, this is not an imperative.

The teachers also articulate the discourse of *qualification as to be critical* (C). This discourse is articulated in relation to 'practice', that is, how students are supposed to deal with questions and habits *in society* from a sustainable viewpoint. The teachers articulate scientific knowledge as a competence, as a resource to critically evaluate scientific credibility. However, at the same time, complex learning opens up for other perspectives, where scientific reasoning is one of them. This in a way comprises 'contradiction' of epistemological views. But, this is also a way for teachers to handle different aims of teaching and comprises differences in epistemological views when it comes to everyday practice; articulated as a qualified way for students to act as educated students, which makes the previous two different discourses come together.

Hence, even if scientific reasoning is an important part of ESD, if we, as a purpose of qualification, treat issues of sustainability mainly as scientific reasoning, that is, 'schooling' with mainly a fact-based science view, we might 'risk' to get ESD as 'pure' science education, that is, as conceptual learning. This would mean a qualification limited to include mainly the functions of (certain) qualification and socialisation, and missing the function of subjectification. Sustainability in this discourse will mainly articulate issues of sustainability as 'matter of facts' (cf. Latour, 2010).

However, promoting a 'citizenship-as-practice' (Van Poeck & Vandenabeele, 2012)—an education which also involves students learning from encounters, the interruption of existing orders and facing conflicts—will organise education as a way *to learn from something* rather than to learn *for something*. In our study, this approach can be seen as relating to teachers' articulation of the more postmodern view of knowledge in *qualification as awareness of complexity*, approaching a more pluralistic view of sustainability issues. In this discourse the education has the possibility to embrace the political and values as a part of education (ESD).

To make a 'matter of facts' into a 'matter of concerns', we might need to bridge the bifurcation of epistemological gaps and try to build composites (Latour, 2004). Latour (2010) refers to 'compositionism' as a way to put things together while retaining their heterogeneity. Composites, in this case, are exemplified by the teachers' articulation of *qualification as to be critical*, with a composition on the one hand of *scientific reasoning* and, on the other, an awareness of the political and open-ended *awareness of complexity*. In this way, *critical thinking* as a *composite* discourse might be seen as a qualification of ESD as an education *to make sense*, to face difference and conflicts as educational contexts *to learn from*.

In this study ESD is not articulated as directly separated from the science education; it rather strengthens certain perspectives and values in science education, which otherwise

might not be a priority in ‘an age of measurements’ (Biesta, 2009). The qualification is formulated according to teachers’ articulations as a *qualification for critical thinking* that reformulates ‘matter of facts’ towards ‘matter of concerns’, a view more in line with a citizenship-as-practice approach (Lawy & Biesta, 2006; Van Poeck & Vandenabeele, 2012), an approach that may be needed to allow students the opportunity to develop new views and ideas and to question our ordinary way of living. Hence, if we find our contemporary lifestyle unsustainable, we argue that this possibility in education is crucial to make students reflect in ways that could lead to new ideas and visions of sustainability.

By prioritising teachers’ experiences from encounters with students as the foundation for reciprocal discussions with colleagues and the starting point for analysis, we have, in this study, been able to show how a variety of perspectives becomes expressed. Therefore, when performing a discourse analysis, it is of importance to also allow the distinctions to develop from a first-person perspective, that is, from living practice.

Disclosure statement

No potential conflict of interest was reported by the authors.

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References

- Barrue, C., & Albe, V. (2013). Citizenship education and socioscientific issues: Implicit concept of citizenship in the curriculum, views of French middle school teachers. *Science and Education*, 22, 1089–1114.
- Beck, U. (1992). *Risk society: Towards a new modernity*. London: Sage.
- Biesta, G. (2004). Democracy – A problem for education or an educational problem? In T. Englund (Ed.), *Five professors on education and democracy* (pp. 87–109). Örebro: Örebro University.
- Biesta, G. (2006). *Beyond learning. Democratic education for a human future*. Boulder, CO: Paradigm.
- Biesta, G. (2009). Good education in an age of measurement: On the need to reconnect with the question of purpose in education. *Educational Assessment, Evaluation and Accountability*, 21, 33–46.
- Grooms, J., Sampson, V., & Golden, B. (2014). Comparing the effectiveness of verification and inquiry laboratories in supporting undergraduate science students in constructing arguments around socioscientific issues. *International Journal of Science Education*, 36, 1412–1433.
- Hasslöf, H., Ekborg, M., & Malmberg, C. (2014). Discussing sustainable development among teachers: An analysis from a conflict perspective. *International Journal of Environmental and Science Education*, 9, 41–57. doi:10.12973/ijese.2014.202a

- Hasslöf, H., & Malmberg C. (2015). Critical thinking as room for subjectification in education for sustainable development. *Environmental Education Research*, 21(2), 239–255. doi:10.1080/13504622.2014.940854
- Jickling, B., & Wals, A. (2008). Globalisation and environmental education: Looking beyond sustainable development. *Journal of Curriculum Studies*, 40, 1–21.
- Laclau, E., & Mouffe, C. (2001). *Hegemony and socialist strategy: Towards a radical democratic politics*. (2nd ed.). London: Verso.
- Latour, B. (2004). Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry*, 30, 225–248.
- Latour, B. (2010). An attempt at a 'compositionist manifesto'. *New Literary History*, 41, 471–490.
- Lawy, R., & Biesta, G. (2006). Citizenship-as-practice: The educational implications of an inclusive and relational understanding of citizenship. *British Journal of Educational Studies*, 54, 34–50.
- Linder, C., Östman, L., Roberts, D. A., Wickman, P. O., Erickson, G., & MacKinnon, A. (Eds.). (2011). *Exploring the landscape of scientific literacy*. New York: Routledge.
- Lundegård, I., & Wickman, P. O. (2007). Conflicts of interest: An indispensable element of education for sustainable development. *Environmental Education Research*, 13, 1–15.
- Lundegård, I., & Wickman, P. O. (2012). It takes two to tango. *Environmental Education Research*, 18, 153–169.
- Roberts, D. A. (2007). Scientific literacy/science literacy. In S. K. Abell & N. G. Lederman (Eds.), *Handbook on research on science education* (pp. 729–780). Mahwah, NJ: Lawrence Erlbaum.
- Sadler, T. D. (2004). Informal reasoning regarding socioscientific issues: A critical review of the research. *Journal of Research in Science Teaching*, 41, 513–536.
- Scott, W., & Gough, S. (2003). *Sustainable development and learning: Framing the issues*. London: Routledge Falmer.
- Stevenson, R. B. (2007). Schooling and environmental education: Contradictions in purpose and practice. *Environmental Education Research*, 13(2), 139–153.
- Sund, L., & Öhman, J. (2014). On the need to repoliticise environmental and sustainability education: Rethinking the postpolitical consensus. *Environmental Education Research*, 20, 639–659.
- Todd, S. (2009). Can there be pluralism without conflict? *Philosophy of Education Yearbook*, 51–59.
- Todd, S., & Säfström, C. A. (2008). Democracy, education and conflict: Rethinking respect and the place of the ethical. *Journal of Educational Controversy*, 3. Retrieved from www.wce.wvu.edu/Resources/CEP/eJournal/v003n001/
- Unemar Öst, I. (2009). *Kampen om den högre utbildningens syften och mål. En studie av svensk utbildningspolitik* [The struggle of defining the purposes and aims of higher education. A study of education policy in Sweden.] Diss. Örebro Studies in Education 27.
- United Nations Educational, Scientific and Cultural Organization [UNESCO]. (2013). *Proposal for a Global Action Programme on Education for Sustainable Development as follow-up to the United Nations Decade of Education for Sustainable Development (DESD) after 2014*. General Conference 37th Session, Paris. 37 C/57.
- Van Poeck, K. & Vandenabeele, J. (2012). Learning from sustainable development: Education in the light of public issues. *Environmental Education Research*, 18, 541–552.
- Wals, A., Brody, M., Dillon, J., & Stevenson, R. B. (2014). Convergence between science and environmental education. *Education forum. Science*, 344, 583–584.
- Zeyer, A., & Dillon, J. (2014). Science environment health-towards a reconceptualization of three critical and inter-linked areas of education. *International Journal of Science Education*, 36, 1409–1411.
- Zeyer, A., & Kyburz-Graber, R. (Eds.). (2012). *Science environment health. Towards a renewed pedagogy for science education*. Dordrecht: Springer.